



Secretariat

Distr.
GENERAL

ST/SG/AC.10/C.3/1998/67
14 April 1998

Original: ENGLISH

COMMITTEE OF EXPERTS ON THE
TRANSPORT OF DANGEROUS GOODS

Sub-Committee of Experts on the
Transport of Dangerous Goods
(Fifteenth session,
Geneva, 29 June-10 July 1998,
agenda item 6)

EXPLOSIVES (CLASS 1)

Proposed testing regime and criteria for the exclusion
of devices from Class 1

Transmitted by the experts from Canada and the Netherlands

INTRODUCTION

1. At the July 1997 Geneva meeting Canada submitted UN/SCETDG/13/INF.10 on possible tests and criteria for the exclusion of devices from Class 1. The paper was not reviewed in July 1997 but was discussed briefly at the informal Working Group on the 6(c) Test held in Washington in February. It was suggested that a formal paper be presented for discussion by the Sub-Committee in July. Canada and the Netherlands put forward this paper.
2. When an article has been demonstrated to behave as a Class 1.4, compatibility group S, it is possible to exclude the article from Class 1, (Box 36 of Table 10.3 in the Manual of Tests and Criteria) provided it meets the definition in Chapter 2.1, paragraph 2.1.1.1 (b) of the Recommendations on the Transport of Dangerous Goods Model Regulations", tenth revised edition, page 41. This paragraph reads as follows:

GE.98-20961

"devices containing explosives substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport shall not cause any effect external to the device by projection, fire, smoke, heat or loud noise;"

3. A variation (unpacked and unconfined) of the 6(a) test is suggested in a note to paragraph 16.6.1.4.7 (a) of the Manual of Tests and Criteria but measurable criteria are not given.

REVIEW and DISCUSSION of DEFINITIONS

4. The definition for excluding an article from Class 1 under this scheme applies to a device, not a substance and only if the article was manufactured with a view to producing a practical explosive or pyrotechnic effect. (Box 35 of Table 10.3 in the Manual of Tests and Criteria).
5. The definition includes "shall not cause any effect" this, in essence, is no effect outside the device. No effect may be interpreted as not detectable by the human senses or by measurement. This would be a very strict interpretation and could possibly prevent the exclusion of any device from Class 1 since sensitive instrumentation is available that could detect minute effects, for example, the smallest heat rise. In the paragraphs below, Canada and the Netherlands propose criteria which could be interpreted as not causing discomfort or possible injury.
6. "their inadvertent or accidental ignition or initiation". The decision is how to set off devices that do not carry their own means of ignition. Canada and the Netherlands propose that the intended means of ignition be used. The prescription for the 6(a) and 6(b) Tests where articles without their own means of ignition are nevertheless functioned also points in this direction (Paragraphs 16.4.1.3.3 (b) and 16.5.1.5 (b) of the Manual of Tests and Criteria).
7. If there is no projection, fire, smoke, heat or loud noise a device may be removed from Class 1. However, if there *is* any projection, fire, smoke, heat or loud noise, then for the device to be removed from Class 1 the possibility of it functioning must be proven to be small. The note for Paragraph 2.1.3.3.1 of the Recommendations reads:

"Theoretical analyses, test, data or other evidence of safety should be provided to establish that such an event is very unlikely. Vibration related to the proposed modes of transport, static electricity, electromagnetic radiation at all relevant frequencies, (maximum intensity 100 W.m²), adverse climatic conditions and compatibility of explosives substances with glues, paints and packaging materials.

8. This paper proposes characteristics that would indicate no effects outside the device. However, if such effects were present but the Competent Authority was convinced that the event was unlikely, the Competent Authority could decide to exclude the device from Class 1. Such exclusion must present supporting evidence, including the testing given in above quote from the Recommendations, "Theoretical analyses.....".
9. "effect external to the device"

Since the concern is one of safety the inherent properties of the device are to be assessed and not how well these properties may be camouflaged by packaging. The test must be conducted on the article outside the packaging. This is clarified in paragraph 16.6.1.4.7 (a) of the Manual of Tests and Criteria.

10. There are a number of devices which use explosives or pyrotechnics to initiate other effects which are not normally considered as belonging to Class 1. For example, a very small squib could initiate a flammable gas mixture. This paper is concerned with the exclusion from Class 1 and not whether the device should be put into another hazardous classification. Therefore the test should determine if the device and effect *caused by the explosives or pyrotechnic itself* and not whether another effect caused by other materials may be present.
11. In the example just cited the evaluation should be done on the squib without any flammable gas. If the device then meets the criteria proposed below it could be considered for exclusion from Class 1. If it meets the criteria for flammable gas it may then be placed into Class 2.1. Another device may, as a result of testing, be completely removed from the provision of the transport of dangerous goods.

PROPOSAL

12. The 6(c) Test is carried out and the article is demonstrated to meet 1.4 S criteria.
13. A single article, outside its shipping container is tested. When required, it will be initiated with its intended means of ignition.
14. Whether external effects are present is measured in the following manner:
 - 14.1 Attach a thermocouple to the outer surface of the device to measure heat as a temperature.
 - 14.2 Place a noise level metre, 45 cm from the device to detect noise. This is approximately arm's length.
 - 14.3 Wrap the device in 2 wraps of tissue paper to detect any fire.
 - 14.4 Place the device in a paper box whose frame is a thin metal such as wire. The frame is covered with 1 layer of newsprint. A standard newsprint should be used, for example one meeting the requirements of British Standard 7114 for Fireworks. No plane side, i.e. newsprint, should be further than 30 cm from the device. This is to witness any projection.
 - 14.5 Place the device, with thermocouple and tissue paper, in the newsprint box. If the device has a preferential mode or direction discharge, this cannot be placed downward.
 - 14.6 Fire the device as it was intended. A qualifying note: the assessment must be based on the functioning of the article and not on that of the ignition system.
15. Some devices may be large and difficult to subject to the above. It should be left to the Competent Authority to decide whether testing only the part of the device containing the explosive would be appropriate. Many of these devices however, are small and can easily be subjected to the testing regime being proposed.

CRITERIA

16. Canada and the Netherlands reiterate the description in the definition: "not cause any effect external to the device by projection, fire, smoke, heat or loud noise" and proposes criteria which, though they could be considered as producing an external effect, are small enough to disregard the explosive or pyrotechnic nature of the device.

- 16.1 The heat criterion is redefined as a temperature. No heat would imply no increase in heat because all articles have some inherent heat. Hence any measured increase in temperature would result from heat being produced. Another approach is to set an upper limit on an acceptable temperature. This is what is proposed.

The maximum temperature is 45°C; this is close to the maximum tolerated temperature to the hand for a short period of time. According to Stoll and Chianta, "Heat Transfer through fabric as related to thermal injuries", Transactions New York Academy of Science" 1970, page 649, 44°C represents the lower limits of injurious temperature. The 45°C maximum represents the no heat effect criterion.

It is important to comment on the choice of this temperature. If we look at the example of oxygen generators where a maximum 100°C for the outside of the package is allowed, the 45°C may appear conservative. However, the 100°C is a maximum allowed for the generators *to be allowed for transport as dangerous goods*. The 45°C is the maximum *allowed for exclusion* from Class 1 and can imply *exclusion from control as a dangerous good*.

- 16.2 The maximum noise level is suggested to be 120 dB(A). This represents the no loud noise criterion.

The definition uses the terms "no loud noise". Setting a measurable is based on perceptions of what is a loud noise. Pain threshold is about 140 dB(A). A recognized standard for continuous exposure is 90 dB(A), lower in some jurisdictions. The proposal sets the level between these extremes, recognizing that the scale is logarithmical.

- 16.3 The tissue paper must not catch fire; this is evidence of no fire. Scorching and similar effects are evidence of heating and are captured by the 100°C maximum temperature.

- 16.4 The newsprint must not be perforated; this is evidence of no projection.

17. Under these criteria it is reasonable to consider that the device meets the criteria given in paragraph 2.1.1.1 (b) of the Recommendations
-

LIST OF GROUP IB SUBSTANCES

UN NO.	SUBSTANCE	LC50 (ppm)	LC10 (ppm)	NOTE	V (20° C) (gpm)	NOTE	RTCS**
UN 1580	Chloropicrin	—	50	R* ^b	26100		PB6300
UN 3023	tert-Octyl mercaptan	102	—	R*	5000		MI1500
UN 2232	2-Chloroethanal (Chloroacetaldehyde)	160	—	A	24300		AB2450
UN 1752	Chloroacetyl chloride	660	—	C	24600		AO6475
UN 2668	Chloroacetonitrile	—	500	R*	13200		AL8225
UN 1182	Ethyl chloroformate	145	—	R	55300		LO6125
UN 1670	Perchloromethyl mercaptan	—	69	R*	32900		PB0370
UN 1672	Phenylcarbylamine chloride	—	1	20000		c	NI6700
UN 2487	Phenyl isocyanate	16	—	A	2470		DA3675
UN 2337	Phenyl mercaptan	66	—	R*	1450		DC0525
UN 1810	Phosphorus oxychloride	96	—	R*	35500		TH4897
UN 1809	Phosphorus trichloride	208	—	R*	125000		TH3675
UN 1695	Chloroacetone, stabilized	262	—	R	41900		UC0700
UN 2485	n-Butyl isocyanate	105	—	C	13900		NQ8250
UN 2743	n-Butyl chloroformate	—	—	1	9870		LQ5890
UN 1569	Bromoacetone	—	95	R* ^b	11900		UC0525
UN 1746	Bromine trifluoride	50	—	cS	9200		EP9360
UN 2740	n-Propyl chloroformate	319	—	Rm	25500		LQ6830
UN 1595	Dimethyl sulfide	17	—	R*	1000		WS8225